(12) UK Patent Application (19) GB (11) 2 167 924 A

(43) Application published 4 Jun 1986

(21) Application No 8529345

(22) Date of filing 28 Nov 1985

(30) Priority data
(31) 3443954 (32) 1 Dec 1984 (33) DE

(71) Applicant
Gebr Eickhoff Maschinenfabrik und Eisengiesserei mbH (FR Germany),
Hunscheidtstrasse 176, 4630 Bochum 1, Federal Republic of Germany

(72) Inventor
Karl-Heinz Weber

(74) Agent and/or Address for Service
Wynne-Jones Laine & James,
Morgan Arcade Chambers, 33 St. Mary Street, Cardiff, Glamorgan

(51) INT CL⁴
H04B 5/00 E21C 5/00 E21D 15/58

(52) Domestic classification (Edition H):
H4L PT
U1S 1247 1263 1763 H4L

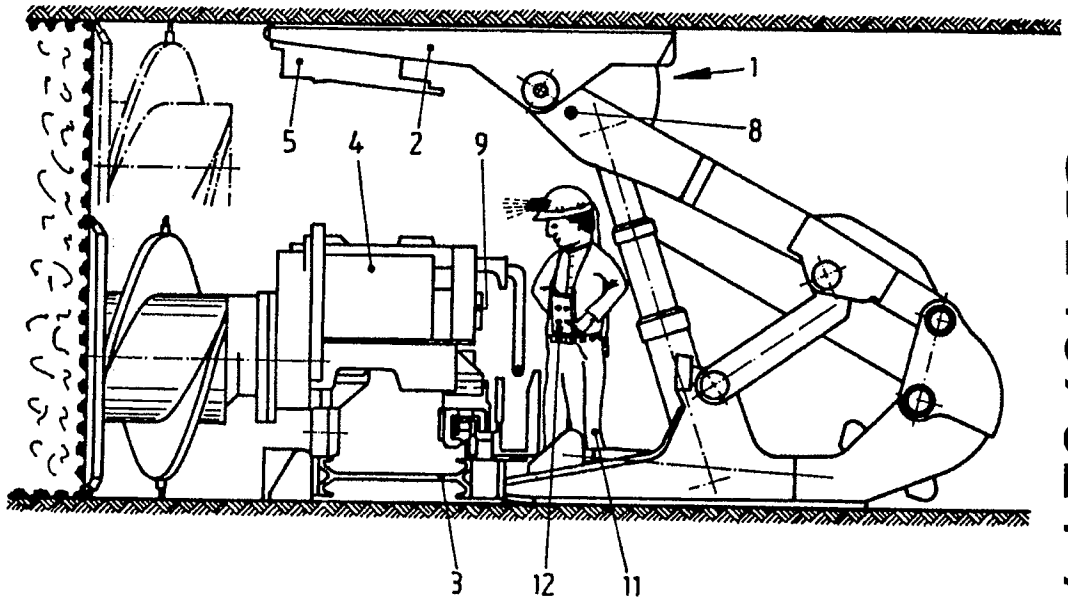
(56) Documents cited
None

(58) Field of search
H4L
Selected US specifications from IPC sub-class H04B

(54) Arrangement for controlling a powered support system used in underground mining

(57) The invention relates to an arrangement for controlling a powered support system (1) for underground mining, the support frame units (1) of the system being controlled individually or groupwise by a common computer (6). The computer stores control instructions it receives, encodes them and supplies them selectively to the various units (1) or to a group thereof by way of a common line (8) in dependence upon the position of the winning machine (4) and of the permissible electrical and hydraulic power of the support system. The position signals transmitted by the winning machine (4) and the control instructions issued by operatives (11) in the face are supplied to the central computer (6) by way of a receiver (10) and radio control transmitters (12) carried by operators. The common control line (8) which is preferably a coaxial line and which connects the computer (6) to the units (1) forms the antenna used to transmit the output signals of the radio control transmitters (12). Alternatively, individual antennae distributed over the length of the face and connected to the common control line (8) are provided.

Fig. 2



GB 2 167 924 A

2167924

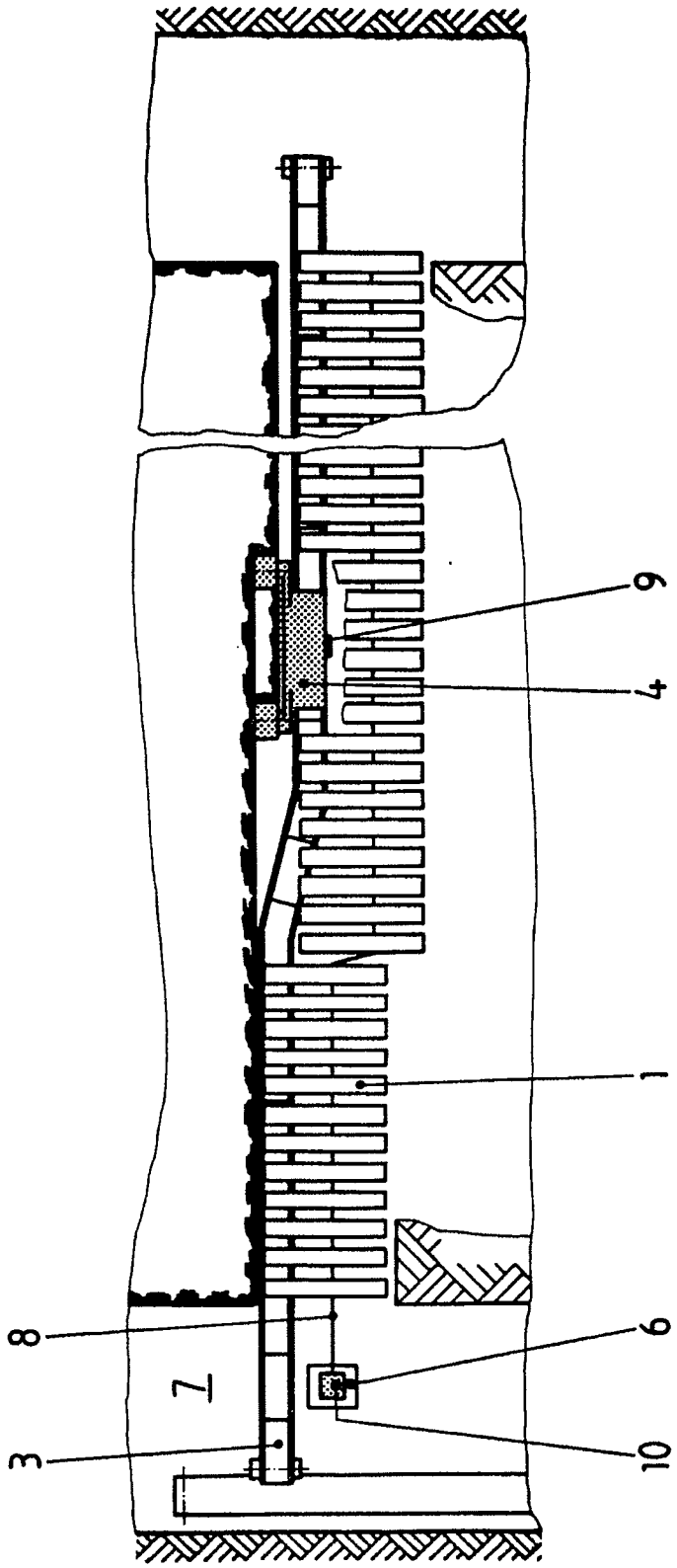


Fig. 1

2167924

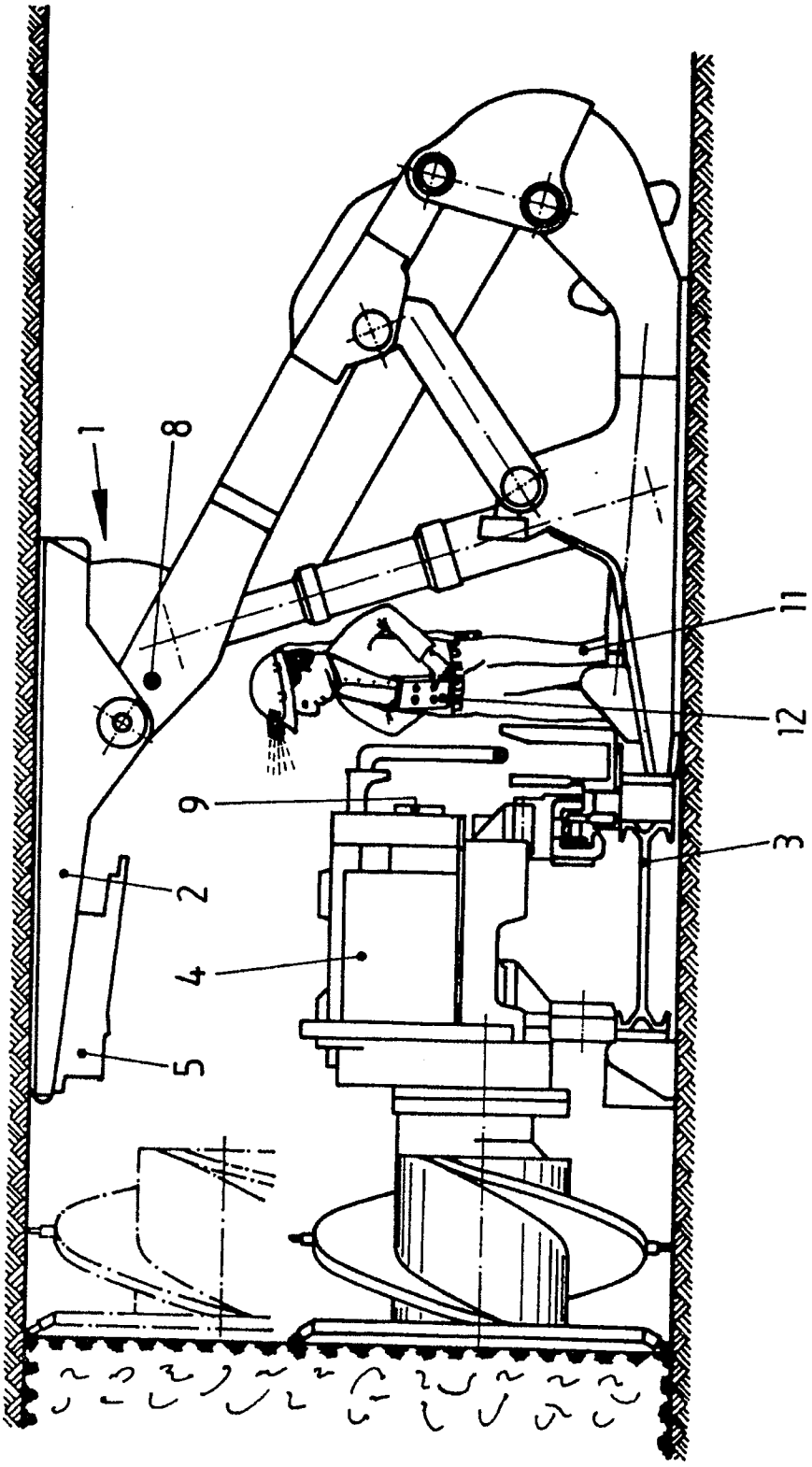


Fig. 2

SPECIFICATION

Arrangement for controlling a powered support system used in underground mining

The invention relates to an arrangement for controlling a powered support system for underground mining. The support units of the system are controllable individually or in groups by a computer which generates control instructions from its control program in dependence upon the position signal of a winning machine used in association with the system and having regard to the permissible electrical and hydraulic power of the support system. The computer being arranged to selectively supply the control instructions thus generated to the various support units or groups thereof and to store "manual" control instructions given by an operative and gate them only between the program instructions.

It is known for all the operations of a support system frame (such as clearing, advancing, setting, moving and other functions) to be performed automatically under computer control, the computer operating from a control station which is outside the face.

Powered support systems have been described in which various frames are controlled in dependence upon the position of an associated winning machine. In this event all the frames of the face or a group of frames are connected to a central control station by a common multiwire control line. Each frame has a control unit having a code corresponding to the frame number. The code serves as address and enables the computer, in response to the winning machine position signals, to supply its control instructions selectively to the particular frame concerned. In this form of control individual frames can be operated manually independently of the computer control, for example, when disturbances have occurred outside the immediate range of operation of a drum cutter-loader of the winning machine and have to be cleared. To this end, two "release" wires connect all the frames of the face to the central control station. One of these two wires transmits the release signals from the automatic-system instructions while the other transmits the release signals for operator-initiated or "manual" instructions. Consequently, a "manual" instruction can go through the wiring system carrying the automatic instructions only if it is disposed in time betwen two pulses of the computer-generated signals produced in response to the winning machine position signal. In this case care is taken to ensure that the manual instructions wire is rendered inoperative for the duration of the various automatic instructions. This is to ensure that there is no risk of disturbances occurring to the computer-initiated control sequence. However, a special "release" wire has to be provided to feed the manual instructions to the computer of the central control station. In addition, manual instructions transmitted from a relatively remote place cannot act on individual frames, and a further control line is necessary to transmit the winning machines position signals.

From one aspect the invention consists in a support system controlled by a central computer, having the ability to be effected by radio from anywhere in a face on any support props or groups thereof and to supply the winning machine position signals to the central computer by radio.

From another aspect there is provided an arrangement for controlling a powered support system for underground mining, the arrangement including a computer having a receiver for controlling the support units of the system individually, collectively or in groups by control instructions generated from its control program in dependence upon position signals indicating the position of a winning machine used in association with the system and having regard to the permissible electrical and hydraulic power of the support system, the computer being arranged to selectively supply the instructions thus generated to the various support units or groups thereof, in a common control line, and to store "manual" control instructions given by an operative and gate them only between the program-generated control instructions, the position signals of the winning machine and/or the "manual" control instructions issued by an operative in the face being transmitted to the receiver of the computer by way of individual radio control transmitters, the receiver using as antenna the common control line of the computer, or individual antennae distributable over the length of the face and connected to the common control line, the antenna or antennae being operative for the transmission of the position signals and/or "manual" control instructions and the latter instructions having already been addressed by the operative to the support frame to be operated.

It now becomes possible for both the winning machine and a number of operatives moving around in the face to transmit to the computer position signals and control instructions directed to a particular frame from anywhere at all, via the individual radio control transmitter allocated to them and by way of the common control line of the frames. The computer can therefore control the support system in dependence upon the machine position. Also, between the various instructions of the automatic system the computer can gate the manual instructions from the various operatives to the frames they have selected, so that any defects of individual frames can be cleared and, for example, hanging bars or coal face props can be moved into their operative position.

Conveniently, the radio control transmitter of

an operative includes a receiver and a display all contained in a common casing. Also, if the common control line (which may be a coaxial line) has a wire for reporting back control instructions and the computer has a transmitter to transmit the reported-back signals, the operative always receives a confirmation of receipt from the frame he has selected. This feature enables a controlled frame to report back after the control instruction has been executed.

Advantageously, the sequence of support frames to be selected and controlled by the computer is reversible by way of the operative's radio control transmitter and frame groups, controllable by the computer program, can be selected individually. This feature enables any operative to act on underground operations, as he requires, by means of his radio control transmitter.

It is also recommended that the control instructions of the computer and the instructions of the radio control transmitters be transmitted by pulse code modulation, since a large number of control instructions and of signals can be transmitted by time multiplexing with a reduced outlay on circuitry.

The invention may be performed in various ways and a specific embodiment will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows a face, including a support system, in plan view, and

Figure 2 shows the face of Fig. 1 in cross-section.

Support frames 1 bridge over a face conveyor 3 for most of the length of a face, by means of their bars 2. The face conveyor 3 movably supports a drum cutter-loader on winning machine 4. Some of the roof area is left free just near the machine 4 and the troughs of conveyor 3 can be moved on to the new working face by advancing cylinders (not shown).

The corresponding advancing movement of the various frames 1 and all the other movements in connection with advancing movement (such as the advance of face conveyors 3, the lowering and raising of the bars 2 and the bleeding and pressurizing of the props 5) are controlled fully automatically by a computer 6 which is disposed in the roadway 7 and which is connected by way of a common control line 8 to all the frames 1. The computer 6 operates in response to position signals from the machine 4; the signals are produced by means of the haulage unit (not shown) and are transmitted from a radio control transmitter 9 associated with the machine body. The transmitted signals are picked up by the common control line 8 which acts as antenna for the receiver 10 of the computer 6. In response to the position signals thus received, the computer 6 addresses the control instructions generated in a predetermined program sequence, feeds them selectively to the frames 1 in the immediate vicinity of the machine 4 and thus triggers the control movements necessary for the cutting operation and, therefore, the placing movements of the frames 1. Consequently, the various frames 1 immediately in front of the machine 4 remove the props from the working face and depressurize themselves after the machine 4 has passed through, initiate the advancing movement of conveyor 3 and their own advancing movement and clamp themselves in a new position between the floor and the roof while simultaneously pressing the prop 5 on the new working face.

In addition each operative working in the face has a personal radio control-transmitter 12 which enables the operatives to act manually on individual frames 1. These transmitters 12, which are portable and carried by the operators 11, transmit the control signals initiated by the operative. Such signals have already been addressed, by the operative, to the particular frame 1 it is required to operate and are fed to the computer 6 by way of the common control line 8 serving an antenna. Without interrupting the programmed control sequence the computer 6 supplies such instruction to the selected frame 1. Consequently, the operatives 11 can act, from wherever they happen to be, on any of the frames 1 in the face and catch up on missed-out movements or correct the instantaneous operational state of a frame 1. All the frames 1 are numbered consecutively to enable the operatives to address their control instructions. The operative can therefore address his control instruction to the particular frame 1 he wants to actuate by keying the frame number on the keyboard of his transmitter 12.

The operatives 11 can also act on the computer 6, using their transmitters, to reverse the control sequence it is transmitting, for example, when the direction of travel of the machine 4—i.e., of the drum cutter-loader or of the coal plough-reverses. This reversal can be effected not only for the individual frame 1 but equally for whole groups of frames to the extent that they perform the control movements at the same time. For example, when a number of frames 1 withdraw their props 5 from the working face in front of the machine 4 simultaneously or when a number of conveyor sections advance simultaneously behind the machine 4, whereafter a number of frames 1 are simultaneously depressurized for advance and then repressurized.

CLAIMS

1. An arrangement for controlling a powered support system for underground mining, the arrangement including a computer having a receiver for controlling the support units of the system individually, collectively or in groups by control instructions generated from its con-

trol program in dependence upon position signals indicating the position of a winning machine used in association with the system and having regard to the permissible electrical and hydraulic power of the support system, the computer being arranged to selectively supply the instructions thus generated to the various support units or groups thereof, via a common control line, and to store "manual" control instructions given by an operative and gate them only between the program-generated control instructions, the position signals of the winning machine and/or the "manual" control instructions issued by an operative in the face being transmitted to the receiver of the computer by way of individual radio control transmitters, the receiver using as antenna the common control line of the computer, or individual antennae distributable over the length of the face and connected to the common control line, the antenna or antennae being operative for the transmission of the position signals and/or "manual" control instructions and the latter instructions having already been addressed by the operative to the support frame to be operated.

2. An arrangement according to claim 1, wherein the operative's transmitter includes a receiver and a display all contained within a common casing.

3. An arrangement according to claims 1 or 2, wherein the common control line has a wire for reporting back control instructions and the computer includes a transmitter for transmitting the report-back signals.

4. An arrangement according to any one of the preceding claims, wherein the operator's transmitter can give general control instructions to reverse the sequence of support frames to be selected and controlled by the computer and/or to select individually the frame groups controllable by the computer program.

5. An arrangement according to any one of the preceding claims, wherein the control instructions of the computer and/or the instructions of the radio control transmitters are transmitted by pulse code modulation.

6. An arrangement according to any one of the preceding claims, wherein the common control line is a coaxial line.

7. An arrangement for controlling a powered support system for an underground machine having a plurality of support units used with a winning machine, the arrangement including a computer for selectively controlling the support units by encoded control instructions in dependence upon the position of the winning machine and the available electrical and hydraulic power of the system, a common control line for feeding the control instructions from the computer to the support units, a transmitter for transmitting position signals indicating the winning machine position and/or an operator transmitter for transmitting operator-initiated control signals addressed to the computer and/or individual support units, a receiver for receiving the transmitted signals and feeding them to the computer, the receiver having either an aerial constituted by the common control line or a number of spaced aerials connected along the common line and disposable over the length of the face.

8. An arrangement for controlling a powered support system for underground mining, substantially as hereinbefore described with reference to the accompanying drawings.

Printed in the United Kingdom for
Her Majesty's Stationery Office, Dd 8818935, 1986, 4235.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.